New Mexico Environment Department
Ground Water Quality Bureau

Memorandum of Meeting
or Phone Conversation

Meeting	Date: **Monday, January 26, 2009**	Time: 10:13 am

Thermo Fisher Scientific – Formerly Eberline

Participants: Phyllis Bustamante, Al Pasteris, Charles Lamborn

Subject: Previous activities on site and waste stream

Discussion:
Alan Pasteris and Phyllis Bustamante of the New Mexico Environment Department (NMED), Ground Water Quality Bureau (GWQB), Superfund Oversight Section (SOS) went to Thermo Fisher – (Formerly Eberline) at 504 Airport Road on January 26, 2006. On site they met with Charles Lamborn who had served as the Health Physicist and Safety Officer for Thermo Instruments from August 2005 to January 2008.

According to Charles Lamborn, Thermo Instruments manufactured instruments to detect radio activity. At the peak of production during Thermo Instruments ownership, 350 employees worked at the Airport Road facility. In approximately June of 2007, production of instruments ceased. In January of 2008, other work including data transfer ceased. Currently on site, there is disassembled equipment and large empty rooms. Charles Lamborn is the only employee on site managing disposal and transfer of all goods and materials remaining on site. Thermo Fisher Scientific does not intend to use this site for manufacturing in the future.

Charles Lamborn stated that during operations they had used some solvents and alcohols, but containers were typically not more that one gallon. He stated that the Hazardous Waste Bureau (NMED) had been on site and had inventoried containers close to the time of closure.

The NMED Radiation Control Bureau is also part of an on site investigation to determine if radiation has migrated away from "wells" used to store plutonium 239, berilium and cesium 137 that were used for instrument calibration. During the week of January 19th, soil borings were removed from the ground around the "wells" for sample collection.

The facility has operated with permits under the radiation control bureau of NMED.

Other - Told Charles Lamborn that the SOS was conducting a follow up to a preliminary assessment conducted in 1995 to ensure that operations beyond that date did not result in a release. Also mentioned that we may request access to obtain soil samples in the future.

Conclusions:
Review HWB and Radiation Bureau Files

Initialed: PAB

Distribution:

[redacted]

Phone Call	Date: Thursday February 26, 2009	Time: 1:10 pm

Thermo Fischer

Participants: Stefan Hrabosky, Phyllis Bustamante

Subject: Thermo Fisher – Eberline closure

Discussion:

Brief discussion on what is going on at the site to include Radiation Control Bureau activities and an investigation by interviewing previous employees on what occurred at the site.

Bryan Couture – will be requesting information on files

Stefan wants to know who from the city is interested in this site.

Stephan wants to get all stakeholders involved as soon as possible so that they do not have to go back after the fact to do more sampling.

Site file
- Status - Waiting for report from RCMB for release into

Conclusions:

We should be hearing from consultant to review files

Initialed: PAB

Distribution:

NEW MEXICO
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Cabinet Secretary

J. C. BORREGO
Deputy Secretary

October 3, 2018

Lance Larson
Analyst in Environmental Policy
Congressional Research Service
Library of Congress

Re: Status of decommissioning

Dear Mr. Larson:

On October 1, 2018, you requested information regarding the radioactive material license for Thermo Fisher, LLC, also known as Thermo Fisher ("Thermo") located at 5981 Airport Road in Santa Fe, NM 87507. In addition to the license, you also requested documentation that supports the decommissioning of this facility, and information on the status of its decommissioning.

On December 1, 2017, C.N. Associates provided the Radiation Control Bureau ("RCB") of the New Mexico Environment Department with a five (5) volume Historical Site Assessment ("HSA") for Thermo. RCB is in the process of reviewing the HSA to ensure it meets the requirements set forth in the Radiation Protection Regulations (20.3 NMAC) and NUREG 1757 for decommissioning facilities. C.N. Associates is a consulting firm that provides comprehensive radiological remediation, decommissioning, health physics and project management services and was hired by Thermo to aid them with decommissioning its facility.

RCB has identified numerous areas within the HSA that will require further clarification; RCB's review will not be finalized until mid-January of 2019. At that time RCB will issue a letter to Thermo requesting revisions and clarifications of certain parts of the HSA. Once the HSA is approved by RCB, Thermo will provide a Decommissioning Plan ("DP") for RCB's review and approval. Much like the HSA review process, RCB will provide comments and feedback to Thermo regarding its DP and once RCB ultimately approves of the DP, Thermo will proceed to decommission the site. The decommissioning process will conclude based on

Thermo's internal timeline to complete the decommissioning and RCB's review of the final Decommissioning Report.

The decommissioning timeline is outlined below:

- December 1, 2017: Thermo submitted the HSA to RCB for review;
- January 15, 2019: RCB estimated completion of the HSA review;
- January 16, 2019: RCB expected to submit a letter to Thermo requesting clarification of the HSA;
- Upon receipt of Thermo's response to RCB's request for clarification of the HSA, RCB will review Thermo's clarifications;
- Assuming Thermo adequately addresses the clarifications that RCB requested, RCB will send a letter notifying Thermo that the next step in the decommissioning process is to provide RCB with a DP;
- If HSA clarifications are not acceptable, RCB will send a letter to Thermo requesting further clarification, which will delay the decommissioning process;
- Assuming the HSA is acceptable, RCB will request Thermo to provide a DP by March 2019. If a site visit is required by Thermo to complete the DP, it may delay the process;
- March 2019: RCB will review the DP. If the DP requires clarifications by RCB, a delay of the proposed schedule will occur;
- If RCB approves of the DP, RCB will send a letter notifying Thermo that the decommissioning process can begin;
- Once the DP is approved, Thermo will have 24 months to complete the decommissioning of the license location pursuant to the Radiation Protection Regulations.

If you require additional information, please do not hesitate to contact me at 505-476-8604.

Sincerely,

/s/ Santiago Rodriguez
Santiago Rodriguez
Radiation Control Bureau Chief
New Mexico Environment Department

SANTA FE REPORTER

Nuclear Neighborhood

A company that made equipment to detect radiation left toxic material in a shuttered Santa Fe building

By Aaron Cantú | September 28, 2017

Enough radioactive material to endanger the whole city in the wrong hands.

That's what was inside an 80-gallon plastic drum secured with duct tape and Velcro, left sitting in an abandoned building on Airport Road as recently as last year.

The old Eberline Instruments facility sits behind a fence near where the southwest Santa Fe thoroughfare intersects South Meadows Road. Sweeney Elementary School is less than 500 feet away, and some homes and businesses are even closer.

The global company that owns the land says the radioactive material called americium-241 was further encased inside a smaller steel drum and sealed air-tight before someone finally took it away. But a letter state officials sent to Thermo Fisher Scientific last summer indicates some toxic material may still remain unaccounted for.

What's bad for Santa Fe is that nearly everything the public knows about property's potential contamination has come from the company itself, a Massachusetts-based world manufacturer of laboratory instrumentation and high-tech equipment with a spotty track record for following safety regulations at its Eberline facility.

It's not just 2 grams of americium-241, a radioactive nuclide resulting from decayed isotopes of plutonium forged in nuclear reactors, that was left sitting around. There was a long list of other similarly toxic radioactive materials used when manufacturing was happening there.

Until a decade ago, the Eberline plant made radiation detection equipment that it shipped to nuclear facilities all over the world. The plant's founder, Howard Clayton Eberline, had imagined in the 1950s that Santa Fe would supply the instruments to facilitate the nuclear energy revolution.

The facility's trajectory from the front lines of this industry to a poison-packed shell on the city's edge is as much a story of industrial decline as it is about a lack of accountability. A review by SFR of half a century's worth of newspaper reporting as well as records from the state Environment Department suggest that Eberline's role as a large employer and the stature of its corporate leadership allowed it to cut corners.

A full account of Eberline's impact on human health has never been conducted. Former workers and those who knew them describe working conditions that could be conducive to radiation poisoning. But it isn't clear whether workers qualify for federal reparations that have been paid to others hurt in the uranium industry, and proving harm would be extremely difficult.

For now, the red building at 5981 Airport Road shrouded by overgrown flora remains empty, lingering like a question about its impact on those who passed through its doors and live near its walls.

Radioactive elements like americium and californium, both of which were handled by workers at Eberline, are carcinogenic. They emit alpha particles which can't penetrate skin but can be inhaled or ingested and lodged in bones and organs, where they destroy nearby cell matter. Americium-241 clings to soil particles and most of it ends up in the dirt, according to the federal Agency for Toxic Substances & Disease Registry.

Eberline workers also interacted with unstable isotopes of uranium, plutonium, caesium and strontium, which can cause deformities and cancer and remain in the environment for years.

Angelo Gallegos worked at Eberline for about 18 years, until the early 1990s. He advanced from the assembly line to become a technician, where he calibrated company equipment against radioactive material. He wore protective clothing and gloves lined with lead to conduct tests on samples that he raised and lowered from a subterranean room.

"Safety was always an issue, making sure everything was safe around us and not getting over-exposed," says Gallegos, who still lives in Santa Fe. He worked long and grueling hours, but the pay was good.

In the rushed assembly environment, Gallegos says he and his colleagues basically trusted the company to keep them safe, but it appears that wasn't always the case. Assembly line workers would handle radioactive material with their bare skin, he says. He remembers a pregnant woman working there.

Jeff Aquino's mother and father met at Eberline during the Cold War's nuclear buildup. Aquino, a tribal member of the Ohkay Owingeh Pueblo, suspects both of his parents developed radiation sickness from their careers in the nuclear industry, which included stints at Los Alamos National Laboratory. His

mother is still alive at 94 and recently gave up on trying to receive compensation from the federal govern[SANTA FE REPORTER]he's since developed—possibly, the family believes—from radiation poisoning.

Aquino's father, who died at 56 in 1993 from pulmonary fibrosis (lung scarring), was one of Eberline's most famous employees: Juan Aquino's woodcarvings were displayed for a time in the Smithsonian, and his art was nationally renowned. He was an active tribal member of Ohkay Owingeh, serving for a time as its governor and designing the seal that the tribe uses today.

For 15 years he also designed company Christmas cards for Eberline, where he worked until 1977, advancing to the role of electronic technician. In his own short autobiography, Aquino says he "performed touch up work on" Eberline's technical manuals.

"I remember he told us one time that they had spilled some chemicals there and they didn't have nothing to clean, no protection to clean it up," says Jeff Aquino. "They ended up cleaning it without any protection or safety."

Radiation exposure in occupational environments can lead to the development of pulmonary fibrosis, which results in the same thickening of lung tissue described in Juan Aquino's medical records.

The labs were "the main employer, more or less, that employed a lot of the Natives and Hispanics; a lot of people developed a lot of illness," Jeff Aquino says. "In the end [my father] couldn't even walk 15 feet without having to stop to catch his breath. That's what really kinda had me worried, because I mean, he's only 56 years old."

The Radiation Exposure Compensation Act passed in 1990 guarantees payouts for those who worked for or lived near uranium mines or mills in 11 states, including New Mexico, prior to 1971 and developed radiation illness from the government's nuclear program. With each passing year, the few Eberline workers who may qualify for the program gets smaller.

Howard Clayton Eberline, who started off at LANL and was later part of the team that designed and built devices to measure the world's first hydrogen bomb test, hoped that his new private company would become "part of the great adventure that is atomic energy," from prospecting to mining, from power reactors "to miracles yet unseen." When he left the company in 1963, Eberline workers had measured radiation from nuclear explosions at the Nevada nuclear testing site and at the Republic of the Marshall Islands.

By 198[illegible] *The Santa Fe New Mexican* described Eberline as the city's largest private employer. That gave m[illegible]owerful corporate leadership. John Dendahl, the late descendant of a prominent local family who would later become chairman of New Mexico's Republican Party, was named president of Eberline Instruments in the 1970s and held prestigious board memberships at the First National Bank of Santa Fe and the Santa Fe Opera Foundation, among others.

In those days, the company was able to bully the city into rubber-stamping a plan for expansion by threatening to move its operations to Albuquerque, after officials requested more time to review Eberline's use of radioactive materials. It still laid off dozens of people after it was purchased in 1979 by Thermo Electron Corporation, which would eventually combine with Fisher Scientific in May 2006 to become a multibillion-dollar behemoth. By that September, the global company announced plans to close the Santa Fe plant, terminating 40 manufacturing jobs.

Operations substantially shut down by the next year, but a few workers remained to continue marketing and sales activities. The Santa Fe site also continued to receive millions of dollars' worth of government contracts until 2011.

What's less clear is why radioactive material remained at the facility for several years after the closure of its manufacturing arm. The New Mexico Environment Department has been—in fits and starts—urging proper clean ever since.

After finding in 2007 that Thermo Fisher failed to maintain adequate records of radioactive material going in and out of the Eberline building, New Mexico's Environment Department allowed the company to supply radiation monitors to city government and emergency workers around the state in lieu of a $51,000 fine.

Thermo Fisher provided inventories to the state that reported nearly all radioactive isotopes had been transported out of the facility by June of 2011, but they offer incomplete details about where the materials were removed to, or how. A year later, Thermo Fisher and the New Mexico Environment Department decided that removing a drum of americium from Eberline was a serious matter, and sent an urgent letter requesting the federal Department of Energy's Los Alamos Site Office help remove it.

Internal communications between Thermo Fisher and New Mexico's Radiation Control Bureau, housed in the Environment Department, show that even though the state had accused the company of not following safety regulations in the past, the company was initially allowed to guide the decision for how to remove the americium.

The state would eventually find, again, that Thermo Fisher violated several nuclear regulations. Among other things, the company misrepresented the amount of radioactive nuclides left in the Santa Fe plant after closure.

Thermo Fisher made three proposals for handling the americium in 2013. The company's Radiation Safety wrote to the bureau that the company formed the ideas in consultation with officials at Los Alamos National Laboratory. The first was just to leave the radioactive material on Airport Road, which Hrabosky acknowledged "poses the greatest risk of inadvertent exposure to workers and the public."

Because the quantity was too high for bulk movement under safety rules, the second was for an outside contractor under LANL supervision to construct a new containment facility on-site at Eberline. That would allow workers to remove americium from the steel container—where it'd been stored since it arrived to Eberline in 2000—and repackage it into at least 200 smaller packages that passed federal safety regulations set by the Department of Transportation. After repackaging, Thermo Fisher would then transport the americium to LANL with an eventual destination of the Waste Isolation Pilot Plant site near Carlsbad. Hrabosky argued that this option, too, would have presented grave risks to the surrounding environment.

The final option, which Thermo Fisher preferred, was to transport the material along the same route but without those pesky rules. Getting an exemption from federal regulations and placing the plastic drum with the americium inside two additional large steel containers in a truck seemed like the best plan, Hrabosky said.

And that's what the state did. It reports that the Environment Department with law enforcement assistance moved the materials in February 2016, and in a press conference in June of that year, Environment Secretary Ryan Flynn and Gov. Susana Martinez lauded the effort as a good solution.

"While it was stable and secure, there was not an appropriate pathway for ultimately disposing of this material," Flynn was quoted as saying in the *Los Alamos Monitor.*

Flynn, now the executive director at the New Mexico Oil and Gas Association, declined to speak with SFR about the removal of americium.

After reviewing the plans to transport the americium out of the area, nuclear energy expert and whistleblower Paul Blanch tells SFR the state's Radiation Control Bureau appears to have defied strict safety standards established by the federal Nuclear Regulatory Commission. A plan of action from the Environment Department shows it was planning to transport the americium in a pickup truck with a boxy steel storage frame.

"If they just bypassed all the regulations and took it to Los Alamos, it's not the proper thing to do, but was probably the safest thing to do to get that shit out of Santa Fe," Blanch says.

The reported amount of stored americium was enough to deliver millions of fatal radiation doses via a "dirty bomb."

Victor D[illegible] the senior public affairs official for the Nuclear Regulatory Commission's Region IV, says the NR[illegible] incident because New Mexico has an agreement with the federal agency granting the state jurisdiction in licensing and overseeing the use of radioactive materials.

But in 2015, the state found Thermo Fisher to be in violation of several rules after the Environment Department issued the company a license in 2012 to transfer the radionuclides. In addition to alleging that Thermo had labeled containers as containing radioactive material and then claimed they were empty, the Radiation Control Bureau also cross-referenced Federal Express shipping data to find a discrepancy between the amount of californium Thermo Fisher said it disposed of and the amount it actually did dispose. Its inspectors found levels of radiation at Eberline to be higher than what Thermo Fisher had reported.

Last February, the Environment Department said Thermo Fisher would not have to admit guilt for the violations in exchange for the company paying for the state to transport the americium to LANL. A settlement between the parties also says there was an unspecified amount of californium left at the facility, and correspondence obtained by SFR in a public records request indicates that the state also inquired last summer about radioactive cobalt and carbon at the site that Thermo Fisher had failed to disclose until after the settlement.

Despite repeated requests, neither officials with Thermo Fisher or with the Environment Department would confirm whether all the known toxic materials have been removed from the building as of press time.

Unless the state says more about what's inside 5981 Airport Road, there's little way of knowing whether anybody should be concerned about what Thermo Fisher left behind.

Angelo Gallegos, the former Eberline technician, was surprised to hear that radioactive material had been there for years after its closure.

"There shouldn't have been anything left in there, really," he says.

Joanna Garcia, who has lived near Eberline for 20 years, says her and her neighbors in the Tiempos Lindos Homeowners Association were never briefed about the state's plans to transport americium last year or whether the site poses a health hazard. Even her cousin, who worked at Eberline for a time, refuses to talk about what went on there.

"We were never educated," Garcia tells SFR. "No one ever discussed the Eberline space. We just know that it was booming at one point, then all of a sudden it was shut down."

For now, the facility is a haunting presence over a suburban landscape, faded from memory if not the environment.

SANTA FE NEW MEXICAN

http://www.santafenewmexican.com/news/local_news/state-orders-radioactive-material-removed-from-warehouse/article_ce673373-5c4e-5f4a-b392-44b0ad398dc7.html

State orders radioactive material removed from warehouse

By Staci Matlock
The New Mexican Jun 3, 2016

The building owned by Thermo Fisher Scientific Laboratory on Airport Road, pictured Friday, where a metal dru radioactive material americum was stored for six years until it was recently ordered to be removed. Clyde Muelle Mexican

A drum containing radioactive material used in smoke detectors and other equipment was stored at a private company's warehouse near Santa Fe's Sweeney Elementary School for years until state inspectors found problems at the facility and ordered the container moved.

It was finally taken to Los Alamos National Laboratory in February.

The drum contained 2.1 grams of americium, a byproduct of decaying plutonium. It was stored at a warehouse owned by Thermo Fisher Scientific Laboratory, a Massachusetts-based company that makes radiation detection and other specialized scientific equipment. Manufacturing operations in Santa Fe shut down in 2007 when Thermo Electron merged with Fisher Scientific International.

"We are in the process of evaluating the material and will determine its final disposition at a later time," a Los Alamos National Laboratory spokesman said about whether the lab will repurpose the americium and use it in research.

The amount of americium in the container weighed less than a penny and was securely stored, according to the company. Staff from Thermo Fisher Scientific and the lab moved the container of americium on Feb. 21. "Residual manufacturing material (small amounts of radioactive material used in smoke detector components) was safely stored on site in accordance with a Radioactive Material License issued by the State of New Mexico," said a statement from Thermo Fisher Scientific.

Nothing about the modest red brick building would have indicated it housed radioactive material. The company did not respond to a question about how it had ensured the radioactive americium was safe and secure. Americium is one of three radioactive materials that have less oversight than plutonium and can be used to make a "dirty bomb" – a conventional explosion that can spread radiation in air and dust.

It is unclear why the state Environment Department decided the container of americium needed to be moved after it had been stored in the warehouse for so many years.

The company paid to have the container transported to Los Alamos.

The state ordered the company to remove the container in 2015 after New Mexico Environment Department Secretary Ryan Flynn directed staff to inspect the facility. The inspection "revealed deficiencies, and then we issued notices of violation," said spokeswoman Allison Majure. The state "worked out a settlement to remove the dangerous material and safely transport it to a secure facility at no cost to the taxpayers."

Inspectors found problems with labeling, inventory, record keeping and drum containment. State officials did not provide details of the violations Friday.

Greg Mello, executive director of Los Alamos Study Group and a former state Environment Department employee, called the americium container situation "pretty weird. Leaving a drum containing americium in a warehouse for that long is not something I would have done," said Mello, who once worked as a hazardous materials specialist. "If it is only 2.1 grams, then why the delay? If it's not very dangerous, why not move it immediately? If it is very dangerous, why not move it immediately?"

Thermo Electron operated for decades out of the facility at 5981 Airport Road. It was originally Eberline Instruments, a company started in 1953 by a former Los Alamos scientist, Howard C. Eberline, who developed radiation-detection devices. At its height in 1981, the company employed 435 people at the plant and sales office.

The company built a detection device that alerted Western nations about the meltdown in 1986 at the Chernobyl nuclear-power plant in the Ukraine.

Los Alamos employees helped move the container of americium from Santa Fe.

"Los Alamos National Laboratory was pleased to assist the State of New Mexico in the safe recovery of commercial radioactive materials from an industrial site in Santa Fe and then safely store that material at the Laboratory," said Charlie McMillan, the lab's director. "This public service to the community could not have been accomplished without the Lab's unique nuclear expertise and the dedication of a team of highly skilled employees."

Americium was discovered as a product of decaying plutonium during the Manhattan Project that created the world's first nuclear bomb, according to the World Nuclear Association. The isotope americium-241 has a radioactive half-life of 432 years and emits alpha particles, which are most dangerous when breathed in.

The U.S. Atomic Energy Commission began selling americium dioxide in 1962 at $1,500 per gram for use in household smoke detectors and later for use in oil well monitoring equipment. One gram of americium oxide is enough to make more than three million household smoke detectors, according to the World Nuclear Association. More recently, given the highly regulated supply of plutonium-238, some space programs are looking to use americium to make thermoelectric generators for space missions. Combined with beryllium, americium also can be used in equipment to measure soil moisture.

Contact Staci Matlock at 505-986-3055 or smatlock@sfnewmexican.com. Follow her on Twitter @StaciMatlock.

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ENERGY AND COMMERCE COMMITTEE

SUBCOMMITTEE ON HEALTH

SUBCOMMITTEE ON DIGITAL COMMERCE AND CONSUMER PROTECTION

Congress of the United States
House of Representatives
Washington, DC 20515

October 29, 2018

Anne Idsal
Region 6 Administrator
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202

Re: Inspection of Thermo Fisher, LLC property at 5981 Airport Road, Santa Fe, New Mexico

Dear Administrator Idsal:

I'm writing to express my concerns about radiological material currently being held at the Thermo Fisher, LLC property located at 5981 Airport Road, Santa Fe, New Mexico.

Beginning in the 1960's, the business located at this site produced radiation detection equipment that required the use and storage of radiological material, including fissile materials such as americium-241.

It is my understanding that the EPA initially identified the facility for investigation under the Superfund program in April 1990 (identification number NMD007106776). The EPA completed a preliminary assessment of potential environmental releases in March 1995 and reached a determination that no further remedial action was needed. Then, in April 2009, the EPA reopened its investigation of potential environmental releases from this facility.

Over the last decade, this area of Santa Fe has seen significant growth and construction. As you know, the handling of radiological material poses risks to both the workers and the surrounding community. The community's concerns about the material at this site were highlighted in a Santa Fe Reporter article entitled "Nuclear Neighborhood, A company that made equipment to detect radiation left toxic material in a shuttered Santa Fe building." (link: https://goo.gl/4AkeSj)

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NEW MEXICO HIGHLANDS UNIVERSITY
UNIVERSITY AVENUE LAS VEGAS, NM

Congress of the United States
Washington, DC 20515

I request that the EPA provides my office with the actions taken as a result of its investigation of the Thermo Fisher, LLC property located at 5981 Airport Road, Santa Fe, New Mexico.

It is vital to my constituents that the radiological material stored at this site is safe, secure, and that it poses no risk to their health or the environment. I look forward to learning the details of EPA's oversight of this property.

Sincerely,

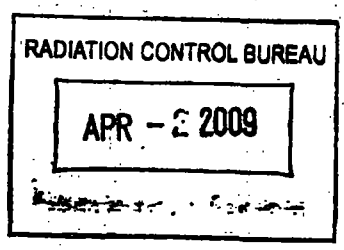
Ben Ray Luján
Member of Congress

NMED RCB April 30

FINAL REPORT

Thermo Fisher

Historical Site Assessment
Former Eberline Facility



5981 Airport Road
Santa Fe, New Mexico 87507

March 2009

ERM Reference 0099013

John W. McTigue, P.G., LSP
Principal-in-Charge

Kenneth Dow
Project Manager

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ACRONYMS

AEC	Atomic Energy Commission
ALARA	As-Low-As-Reasonably-Achievable
AOC	Area of Concern
AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
CFS	Cubic Feet per Second
DCGL	Derived Concentration Guideline
EDR	Environmental Data Resources, Inc.
ERM	Environmental Resources Management
FEMA	Federal Emergency Management Agency
FINDS	Facility Index Database System
FR	Federal Register
FSS	Final Status Survey
HSA	Historical Site Assessment
MDA	Minimum Detectable Activity
MSL	Mean Sea Level
NCDC	National Climatic Data Center
NEAP	National Events Action Plan

NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMEMNRD	New Mexico Energy, Minerals and Natural Resources Department
NMSE	New Mexico Office of State Engineer
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NWS	National Weather Service
PM	Particulate Matter
RCB	Radiation Control Bureau
RCRA	Resource Conservation and Recovery Act
RSO	Radiation Safety Officer
SARA	Superfund Amendments and Reauthorization Act
SEC	Safety & Ecology Corporation
SF	Square Feet
SIP	State Implementation Plan
SQG	Small Quantity Generator
TMO	Thermo Fisher Scientific
TSDF	Treatment, Storage, or Disposal Facility
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Survey
UST	Underground Storage Tank
WRCC	Western Region Climate Center

EXECUTIVE SUMMARY

Thermo Fisher Scientific (TMO) notified the New Mexico Environmental Department (NMED) Radiation Control Bureau (RCB) on 6 June 2007 of their intent to cease principal manufacturing activities and begin the process of decommissioning of the former Eberline Instrument Corporation facility located at 5981 Airport Road in Santa Fe, New Mexico. The facility, constructed in 1968, developed, manufactured and serviced radiological detection instrumentation and utilized radioactive source materials under a Radioactive Material License issued by the RCB. The process of decommissioning this facility requires the safe removal of licensed radioactive materials and confirmation that any remaining residual radioactivity is at a level that permits release of the property for unrestricted release and termination of the Radioactive Material License.

Environmental Resources Management (ERM) and Safety & Ecology Corporation (SEC) were retained by TMO to assist in the identification of remaining radiological materials, the management of those radiological materials remaining at the site, and to assist with facility decommissioning.

This Historical Site Assessment (HSA) Report was prepared by ERM/SEC as a first step in the decommissioning process leading to termination of the TMO radioactive materials license. The primary purpose of the HSA is to complete a detailed review of readily available historical records and information concerning the site and its surroundings from the start of facility operations to the present time in an effort to:

- Document site physical and demographic characteristics in support of the Decommissioning Plan;
- Document site operations involving radiological materials use and management at the site;
- Identify potential Areas of Concern (AOCs) where radioactive materials use could have resulted in radiological impacts to the site building, structures and/or the environment (e.g., soil and groundwater);
- Complete a preliminary classification of areas of known radiological impact, potential radiological impact and non-impacted areas; and
- Develop a site conceptual model and approach to field investigations in support of sampling to characterize the potential for radiological impacts to buildings, structures and environmental media.

The HSA Report includes a summary of site and surrounding area characteristics, the use, storage and management history of radioactive materials at the site, a summary of radiological spills or any known release incidents, and the identification of potential AOCs to support site-specific characterization of known and/or potential radiological impacts to buildings, structures and/or the environment. From this information, areas of the site are initially classified based on known or potential radiological impacts to define future sampling requirements to appropriately characterize the site. Please note that the HSA details only radiological information from the site; non-radiological information would be provided as necessary during due-diligence investigations to support transfer of the property.

The areas of the facility that stored or managed radiation sources and radioactive materials were identified during the interview process, which included the following:

- Engineering Source Storage Closets;
- Shipping and receiving areas;
- Customer service areas; and
- Laboratory and calibration areas.

Other rooms or areas of interest where potential radioactive contamination may be present include the areas identified where Eberline products were returned by customers for service. Since radiation survey instruments were used by clients in locations that contain radioactive materials, it is possible that returned instruments may have been a source of contamination. The areas of interest include rooms where Eberline products were received and serviced. Areas that stored radiation sources or radioactive materials were previously surveyed in 2008 by ERM/Dade Moeller and found to be free of contamination.

Based on former employee interviews and review of site records, there has been no radiological remediation performed at the site. In addition, to the best of their knowledge and with only two exceptions, there were no releases or spills of radioactive materials at the site during their tenures with Eberline. One reported incident regarding radioactive material was a release of Carbon -14 in a dosimetry trailer located outside the building, date unknown. The trailer apparently housed a dosimeter read out facility and the use of C-14 was presumably associated with calibration or source checks of radiation detection instruments. The quantity of C-14 would therefore have been minor. There is no mention of processes that

would have involved significant quantities of C-14 either within the interviews or as a licensed component.

The second incident involved the apparent breach of a source in a calibration well. This source contained about 16 curries (Ci) of Cs-137. The material is presently in the high range subsurface storage well and plans are being formulated to remove the well and the source material for disposal as part of site decommissioning and license termination.

There were no other reports of accidents, incidents or events regarding the use, handling, shipping or storage of radiation sources or radioactive materials at the former Airport Road facility. None of the interviewees reported the misuse of radiation sources.

No on site burials of radiological materials are known to have occurred at the site. There is evidence of disturbed soil on the northeast area of the property and a drain to the parking lot area, which will be included in the planning of outside soil surveys and sampling.

In March 2008, Dade Moeller & Associates (DMA), under contract to ERM performed a radiological scoping survey at the 5981 Airport Road facility. The survey included production, laboratory, engineering, and general office space, and consisted of surface scans and smear samples on walls and floors. In addition, each radioactive source well was scanned and logged for gamma radiation. Upon completion of the survey it was determined that all accessible areas scanned were free from radioactive contamination except for two locations of fixed floor contamination adjacent to the high range well within the Radioactive Source Well Room.

Subsurface soil sampling was performed at the site in and around the area of the four radioactive source wells between December 2008 and January 2009. A total of eleven (11) soil borings were advanced to evaluate the extent of potential radiological impact to soil associated with the storage of sources in the wells. Nine borings were advanced around the neutron source wells, and two targeted the former high range Cesium-137 calibration well. No radionuclides were detected in subsurface soil that can be attributed to licensed operations of the facility. These results were discussed with the RCB and were found to be in agreement with split sample analysis conducted by the RCB.

Based on the developed conceptual site model, TMO will develop a Field Sampling Plan that will include investigation of potential radiological residues from interior operational areas previously inaccessible, identified interior and exterior AOCs, roof areas, ventilation ducts, liquid drains, and groundwater.

The results of site characterization conducted will act as the basis for identifying radiological impacts to building structures and/or the environment that will be addressed through the process of site decommissioning. A site Decommissioning Plan will be developed that will outline the steps remaining to complete decommissioning including identification of remedial areas and site release goals, remedial methods and means of waste management, final status survey requirements to verify that remedial goals have been achieved, and the financial assurance necessary to support site decommissioning. Following public notice and approval of the Decommissioning Plan by the RCB, TMO will then file an amendment to the facility radiological materials license to include the Decommissioning Plan to the license, complete site decommissioning, and apply for termination of the radioactive materials license for the site following decommissioning activities.

1. INTRODUCTION

1.1 BACKGROUND

Thermo Fisher Scientific (TMO) notified the New Mexico Environmental Department (NMED) Radiation Control Bureau (RCB) on 6 June 2007 (Appendix A), of their intent to cease principal manufacturing activities and begin the process of decommissioning of the former Eberline Instrument Corporation facility located at 5981 Airport Road in Santa Fe, New Mexico (defined as the "site" or "facility") shown on Figure 1-1. In addition, TMO has also provided various correspondence concerning characterization and decommissioning options, planned activities, as well as proposed schedules for RCB consideration and comment (Appendix A). The facility, constructed in 1968 and subsequently added to in 1978, developed, manufactured and serviced radiological detection instrumentation and utilized radioactive source materials under a Radioactive Material License issued by the RCB (Appendix B). The process of decommissioning this facility requires the safe removal of licensed radioactive materials and confirmation that any remaining residual radioactivity is at a level that permits release of the property for unrestricted release and termination of the Radioactive Material License.

Environmental Resources Management (ERM) and Safety & Ecology Corporation (SEC) were retained by TMO to assist in the identification of remaining radiological materials, the management of those radiological materials remaining at the site, and to assist with facility decommissioning.

1.2 PURPOSE & SCOPE

This Historical Site Assessment (HSA) Report was prepared by ERM/SEC as a first step in the decommissioning process leading to termination of the TMO radioactive materials license (Figure 1-2). The content of the HSA is consistent with published Nuclear Regulatory Commission (NRC) guidance, primarily the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) and the Consolidated Decommissioning Guidance (NRC, 2000 and 2006). The primary purpose of the HSA is to complete a detailed review of readily available historical records and information concerning the site and its surroundings from the start of facility operations to the present time in an effort to:

- Document site physical and demographic characteristics in support of the Decommissioning Plan;
- Document site operations involving radiological materials use and management at the site;
- Identify potential Areas of Concern (AOCs) where radioactive materials use could have resulted in radiological impacts to the site building, structures and/or the environment (e.g., soil and groundwater);
- Complete a preliminary classification of areas of known radiological impact, potential radiological impact and non-impacted areas; and
- Develop a site conceptual model and approach to field investigations in support of sampling to characterize the potential for radiological impacts to buildings, structures and environmental media.

The HSA Report includes a summary of site and surrounding area characteristics, the use, storage and management history of radioactive materials at the site, a summary of radiological spills or any known release incidents, and the identification of potential AOCs to support site-specific characterization of known and/or potential radiological impacts to buildings, structures and/or the environment. From this information, areas of the site are initially classified based on known or potential radiological impacts to define future sampling requirements to appropriately characterize the site.

The results of site characterization conducted in support of the HSA will act as the basis for identifying radiological impacts to building structures and/or the environment that will be addressed through the process of site decommissioning. A site Decommissioning Plan will be developed that will outline the steps remaining to complete decommissioning including identification of remedial areas and site release goals, remedial methods and means of waste management, final status survey requirements to verify that remedial goals have been achieved, and the financial assurance necessary to support site decommissioning. Following public notice and approval of the Decommissioning Plan by the RCB, TMO would then request an amendment to the facility radiological materials license to include the site decommissioning plan, to complete site decommissioning, and apply for termination of the radioactive materials license for the site following decommissioning activities.

This HSA Report is specific to the use, storage, spill or release of licensed radiological materials at the site in support of radiological decommissioning and termination of the radiological materials license. Assessment of the use, storage, spill or release of oil and/or hazardous materials at the site is beyond the scope of the HSA. Assessment of potential impacts to the site associated with non-radiological constituents will be conducted following termination of the radioactive materials license in support of a future sale of the property.

1.3 *REPORT ORGANIZATION*

The remainder of this report is organized in the following sections:

Section 2.0: Site Description: Documents the physical, demographic and environmental characteristics of the site and the surrounding area including: Facility Location and Description; Current and Future Land Use; Population Distribution; Meteorology and Climatology; Geology and Seismology; Surface Water Hydrogeology; Groundwater Hydrology; and Natural Resources.

Section 3.0: Facility Operating & License History: Documents interviews with former employees of the facility; the operations and the history of use, storage and release/spill of radiological materials at the site; and the history of the radiological materials license, amendments and compliance.

Section 4.0 Records Review: Documents the results of federal, state and local records reviews and available public information regarding the history and use of the site.

Section 5.0 Decommissioning Objectives: Documents site decommissioning objectives to be described in the Decommissioning Plan and includes an initial radiological classification of site areas as impacted, potentially impacted and non-impacted.

Section 6.0 Conceptual Site Model & Characterization Plan: Presents a conceptual model describing the potential for radiological materials to impact buildings, structures and the environment and an initial site sampling and characterization plan.

2. SITE DESCRIPTION

2.1 FACILITY LOCATION AND DESCRIPTION

The former Eberline Instrument Corporation facility is located at 5981 Airport Road in Santa Fe County, northern New Mexico (defined as "site" or "facility") shown on Figure 1-1. It is approximately 6.5 miles southwest of the Santa Fe Plaza, approximately 58 miles north-northeast of the City of Albuquerque, and approximately 25 miles southeast of the City of Los Alamos.

The site, situated between the Sangre de Cristo mountains to the east and the Rio Grande River to the west, occupies approximately 11.4 acres in topographic Section 12 of T16N, R8E (latitude 35.6369 north, longitude 106.037 west) at an elevation of 6,497 feet above mean sea level (msl). Figure 2-1 illustrates the site location, local setting, and shows the regional topography around the site gently sloping from east to west at a gradient of approximately 0.01 feet/foot.

The site contains two structures totaling 66,600 square feet (SF). The southern structure (41,600 SF) was constructed by Eberline Instrument Corporation in 1968. A 25,000 SF addition, referred to as the Engineering Annex, was added on the northern end of the existing building in 1978 (Figure 2-2). The two buildings are connected by a covered loading dock. The structures consist of a concrete slab on grade with cinder block wall construction, with either brick facing or cement plaster on the exterior, and painted or dry-wall construction on the interior. The roof is constructed of pre-cast concrete sections with an angled tile canopy around the perimeter of the building. Selected construction drawings are provided in Appendix C. Site photographs are included in Appendix D.

The four radiological source wells are located in the northeast corner of the main building. These were added to the facility shortly after the completion of the main structure. From west to east, the wells consisted of a Neutron Source Well, a Low Range Calibration Well, a Mid Range Calibration Well, and a High Range Calibration Well. Original construction sketches and photographs of the wells, including historic photographs of sealed sources within the wells, are provided in Appendix C and D, respectively.

Utilities servicing the facility include electric, natural gas for building heat and cooling, as well as city water and sewer (Appendix C). These utilities

were connected at the time of construction. There is no evidence that potable wells or septic systems were installed at the site. The high pressure gas and water lines enter the facility on the east side of the site off of Airport Road. Sink and floor drains throughout the facility are connected to the City of Santa Fe sewer system at the rear (north) of the facility that connect to an eight inch sewer main running north on Industrial Park Road. A sewer ditch easement exists along the north of the facility, which is shown the site aerial photographs (Appendix E).

Review of available records, site reconnaissance and personnel interviews indicate that there were no Aboveground Storage Tanks (ASTs) or Underground Storage Tanks (USTs) installed at the facility. All materials brought into the facility were in small quantities (55-gallon containers or less); there was no record of bulk deliveries to, or storage of, oil or hazardous materials at the facility.

The facility is accessed by two driveways off Airport Road; a gravel drive to the east that wraps around the facility to the loading dock area, and a paved drive on the west that leads to the main parking lot and access to the facility (Figure 2-2). The immediate area surrounding the facility is landscaped, while the rear (north) of the facility remains undeveloped. The parking lot drains gently to a shallow unlined ditch along the western edge of the property, which leads to a culvert beneath Airport Road (Appendix C, D and E). The majority of stormwater from the facility, including roof drains, lead to the parking lot, with the main roof drain connected to a subgrade dry well (Appendix C).

2.2 *CURRENT AND FUTURE LAND USE*

The subject property sits immediately outside the Santa Fe City Limit, and is currently zoned as commercial/industrial by the Santa Fe County Land Use Department. The surrounding properties are zoned primarily residential with mixed commercial located along Airport Road.

The surrounding properties currently contain:

- Vacant land to the immediate north with residential dwellings to the northeast;
- South Meadows Road to the east with a commercial gas station (Conoco) beyond;
- Airport Road to the south with commercial properties beyond to the south and south-southwest; a school (Sweeney School) lies to the south-southeast; and
- Residential dwellings to the west.

Based on communication with the County Land Use Department regarding future land use, the City of Santa Fe will be annexing the entire Agua Fria Traditional Historic Community including the subject property (ERM, 2009a). Figure 2-3 is a map of the future land use in the area of the site obtained from the City of Santa Fe zoning website (City of Santa Fe, 2009). As shown, the site will fall under an "industrial" zoning designation and surrounding property zoning will include commercial, residential, parks, and public/institutional.

2.3 *POPULATION DISTRIBUTION*

As described previously, the former Eberline facility is located within Santa Fe County adjacent to the City of Santa Fe, New Mexico (Figure 1-1). Demographic data for the 2000 census are available from the US Census website for various land areas (US Census, 2000). In 2000, the total population for the county was 129,292, with the Census Bureau projecting a 2007 population of 142,955 (and average annual increase of approximately two percent). Population projections for the county (calculated using the state level projections to determine an average increase to 2030 of 0.51 percent per year and applying that rate to the county population in 2000) show an expected population of approximately 150,000 by 2030. Table 2-1 summarizes the projected population data.

Based on the site's location, an area of approximately one square mile centered on the site was considered in the detailed evaluation of population data. Within the search area around the facility, the following census tracts and associated block groups were identified:

- Census Tract 12.01, Block Groups 2 and 3;
- Census Tract 12.03, Block Group 1; and
- Census Tract 13, Block Groups 1, 2, and 3.

Within the block groups noted, population data were reviewed based on census blocks (the smallest area for which census information is collected). 58 census blocks were determined to be within the search area. Note that blocks partially within the search area were classified as "in" or "out" based on the fraction of the block within the area. The included blocks were sorted by compass direction into four quadrants, with "north" including every block from NE to NW and so on for the remaining directions.

The block-level population data and quadrant location information are summarized in Table 2-2. As shown, the total population of all blocks was 8,218 with the largest fraction (3,923) present to the east of the facility and the smallest (575) to the south.

Based on the census blocks, race data obtained for the county as a whole shows the majority (74.7 percent) of residents are Hispanic/Latino, followed by non-Hispanic white residents making up 19.8 percent, with all other races (Native American, Black, Asian, Pacific Islanders, etc.) making up the remaining 5.5 percent.

2.4 *METEOROLOGY AND CLIMATOLOGY*

Understanding the meteorology and climatology of the site area is an important element of the HSA. Wind and precipitation may carry radionuclides, and when combined with other physical characteristics of the site summarized below, may contribute to runoff to surface water or infiltration to groundwater. This information, combined with rainfall rate and wind direction, will contribute to development of a Conceptual Site Model (CSM), discussed further in Section 6.0 of this HSA.

Santa Fe is located in the northern Rio Grande Valley of New Mexico, situated in the foothills of the Sangre de Cristo mountain range. New Mexico in general has a mild, arid or semiarid, continental climate with associated characteristics of low precipitation totals, significant sunshine, low relative humidity, and a relatively large temperature range (annually and daily).

Meteorological data and summary information were derived primarily from the websites of the Western Regional Climate Center (WRCC) (http://www.wrcc.dri.edu) and the New Mexico Climate Center (http://weather.nmsu.edu/). Specific data from weather stations in proximity to the subject property, including the broadcast station KSAF weather station at the Santa Fe County airport (approximately 2.5 miles west-southwest of the site), a weather station at the Santa Fe Police Academy (approximately 0.84 miles to the southeast), and the Santa Fe 2 weather station (approximately four miles northeast of the site) was used to describe conditions at the site.

Wind

Based on data collected between 1996 and 2006 at the KSAF weather station, the annual average wind speed is 9.5 miles per hour with the highest winds occurring during the months of April and May (Table 2-3).

Prevailing wind direction, measured hourly at the KSAF station from 1992 to 2002, is from the north as shown in Table 2-4. Figure 2-4 illustrates prevailing wind via a wind rose plot of data from the Santa Fe Police Academy weather station for 1999 hourly readings.

To evaluate atmospheric stability, Pasquill stability class information was sought out based on data sets at the nearest weather station to the site (the Santa Fe Police Academy). ERM obtained hourly data from the Academy weather station for 1996 and 1997 (the most recent atmospheric data sets that included Pasquill class designations) from the New Mexico Environment Department's Air Quality Bureau. Evaluation of those data sets showed an average annual Pasquill stability to be between C (slightly unstable) and D (neutral), closer to the neutral designation.

Temperature

Climatological data in the form of climate normals prepared by the National Climatic Data Center (NCDC) and downloaded from the Western Region Climate Center (WRCC) website for the Santa Fe 2 weather station are summarized in Table 2-5. The normals are based on data collected between 1971 and 2000. As shown, the annual mean temperature at the weather station is 49.4° Fahrenheit (F) with a monthly mean range from 29.3°F in January to 69.8°F in July. The mean temperature ranges from 34.2 to 64.7°F on an annual basis.

Precipitation

Precipitation in the area is focused around brief thunderstorms during the months of July and August that accounts for approximately 30 percent of the annual total. This is supplemented by frontal events throughout the year linked in general to Pacific Ocean storm movement across the continent.

Data from the Santa Fe 2 weather station NCDC normals (Table 2-5) show that total precipitation averages 14.22 inches per year. The lowest mean monthly precipitation (0.5 inches) occurs in February and the highest mean precipitation (2.25 inches) is recorded in July. Despite the mean normal values, it is not uncommon for a month to pass without any precipitation in the arid climate of New Mexico.

An annual average snowfall of 19.4 inches was recorded for the Santa Fe 2 weather station between 1972 and 2007 (Table 2-6), with the highest averages measured in December. Despite the positive average snowfall reported for all months from October to April, accumulation is limited and only January has a positive value for average snow depth.

Relative Humidity

Relative humidity information is presented for various New Mexico locations for both morning and afternoon by the WRCC. Although the data set does not include Santa Fe specific stations, the relative humidity data for the City of Albuquerque (further south in the Rio Grande Valley) is considered representative due to the similar physical setting. The WRCC data, summarized in Table 2-7, shows annual average relative humidity levels at 60 percent and 29 percent for the morning and afternoon time frames respectively. The lowest humidity measurements were recorded during the months of December and January while the maximum values occur during May and June.

Evapotranspiration

As would be expected in an arid climate such as that of New Mexico, evapotranspiration occurs at quite high rates. Pan evaporation data measured from 1972 to 2005 for the Santa Fe 2 weather station (included in Table 2-8) show an average annual evaporation of 60.22 inches. No net evaporation is reported for the months of November through March, and the highest monthly average is 11.31 inches in June.

Severe Weather

Severe weather events that took place in Santa Fe County from January 1, 1950 to November 30, 2008 are summarized in Table 2-9 (NCDC, 2009). As shown, a total of 136 severe storm events were recorded over that time frame, including:

- 20 tornadoes;
- 54 hail events; and
- 20 thunderstorm-related high winds.

The severe events in Santa Fe County resulted in three deaths, 13 injuries, and over 1.2 million dollars in damage to property and crops.

The duration and intensity of precipitation events anticipated based on data from the Santa Fe 2 weather station is reported by the National Weather Service and is included as Table 2-10 (NWS, 2009). As an example, the table shows an estimated 1.96 inches of precipitation could be expected in a 60-minute duration event every 100 years.

Air Quality

The US EPA regulates National Ambient Air Quality Standards for criteria pollutants, including carbon monoxide, nitrogen dioxide, ozone, lead, particulate (PM 2.5 and PM 10), and sulfur dioxide, as defined in the Clean Air Act. The standards designate three classifications related to ambient air quality:

1. Attainment Areas – areas in which the concentrations of each of the six criteria pollutants do not exceed the Ambient Air Quality Standards

2. Nonattainment Areas – Areas in which the concentration of each of the criteria pollutants exceed the standards

3. Maintenance Areas – Areas which have previously been designated as Nonattainment, but which have improved and area currently considered Attainment.

There are four Nonattainment or Maintenance areas in New Mexico according to the New Mexico Environment Department Air Quality Bureau website (NMED, 2009b). All of these areas are south of the site, near the state boarders with Mexico and Texas. The following list and narratives were obtained from the website:

- **Ozone Maintenance area in Sunland Park**
  The EPA designated this area as a marginal nonattainment area for ozone in July 1995. The nearby urban areas of El Paso, TX and Ciudad Juarez, Mexico are suspected of being the source of much of the air pollution in this area.

- **PM10 nonattainment area in Anthony**
  The State of NM submitted the Anthony PM10 State Implementation Plan (SIP) to the regional EPA headquarters in November 8, 1991. The nonattainment area is bounded by Anthony Quadrangle, Anthony, New Mexico - Texas. SE/4 La Mesa 15' Quadrangle, N32 00 - W106 30/7.5, Township 26S, Range 3E, Sections 35 and 36 as limited by the New Mexico/Texas State line on the south.

- **SO2 maintenance area at the Phelps Dodge Smelter**
  This maintenance area is located at the Phelps Dodge Chino Copper Smelter in Grant County. The maintenance area is defined as a 3.5-mile radius region around the smelter. The maintenance area also includes high elevation areas within an 8-mile radius.

- **The Doña Ana County Natural Events Action Plan for PM10**
  In December 2000, the Bureau submitted a Natural Events Action Plan (NEAP) for the county of Doña Ana.

Each of these classified areas are within close proximity of each other, with the nearest to the site being the Phelps Dodge Copper Smelter in Grant County, New Mexico, approximately 277 miles south of the former Eberline site.

2.5 *GEOLOGY AND SEISMOLOGY*

Another key component to developing the CSM is understanding the regional and site geology and seismology. This information will assist with defining the potential horizontal and vertical extent of potential radiological contamination, as well as the potential transport of contaminants to surface or groundwater.

Regional Geology

Santa Fe, New Mexico is situated within the Mexican Highland Section of the Basin and Range Physiographic Province and adjacent to the southern border of the Southern Rocky Mountain Province. The area is typified by structural basins bounded by block-faulted mountains and rivers incising the basin fill deposits (New Mexico Geological Society, 1996). The city, and former Eberline facility, lie within southeastern portion of the sediment-filled Española Basin, bounded to the east by Precambrian crystalline rocks of the Sangre de Cristo Mountains and to the west by Tertiary age volcanic rocks associated with the Jemez Caldera (Figure 2-5).

The Española basin is filled primarily by sediments of the late Tertiary – early Quaternary Santa Fe Group, derived from Precambrian rock exposed to the east and north. To a lesser degree, sediments derived from the Jemez volcanic field to the west are present (Broxton and Vaniman, 2004). In addition, more recent Quaternary alluvium (five – 40 feet in thickness) in the form of fluvial terraces and fan deposits unconformably overly the older sediments (Lazarus and Drakos, 1995).

The Santa Fe Group consists of gravel, sand, and clay in lenticular unconsolidated to moderately consolidated deposits. Interbedded volcanoclastic sediments are present is some areas. The more recent basin fill (Quaternary) is primarily unconsolidated interbedded gravel, sand, silt, and clay (S. G. Robson and E. R. Banta, 1995). Broxton and Vaniman (2004) note that the total thickness of the Santa Fe Group is debated, but report various researchers estimates ranging from 4,800 ft in the eastern

and northern part of the Española basin to 10,000 ft based on cross-sections prepared for the central and western parts of the basin.

Strata deposited prior to the basin development, including upper Paleozoic (Mississippian to Permian), Mesozoic, and Cenozoic sedimentary rocks, are believed by some researchers (S. G. Robson and E. R. Banta, 1995; and others as cited in Broxton and Vaniman, 2004) to be present beneath the Santa Fe Group within the Española Basin. Other references report the upper Paleozoic, Mesozoic, and Cenozoic rocks were stripped from the Española Basin area completely prior to the deposition of the Tertiary Santa Fe Group (Broxton and Vaniman, 2004).

Thus, bedrock formations that bound the basin either consist of granite, quartzite, schist, and gneiss of Precambrian age only, or include marine carbonates, volcanics, and clastic sedimentary rocks of Paleozoic age and clastic sedimentary rocks and volcanic rocks of Mesozoic and Cenozoic age underlain by the Precambrian crystalline rock (S. G. Robson and E. R. Banta, 1995; Broxton and Vaniman, 2004).

Figure 2-6 is a graphic describing the geologic history and stratigraphy of the region (Johnson, 2001).

Site Geology

As discussed above, the facility sits atop basin-fill sediments of Tertiary to Quaternary age. Figure 2-7 is a geologic map of the Agua Fria topographic quadrangle that includes the site. As shown on the map, modern (Holocene) unconsolidated sheet-wash deposits directly underlie the site, with older Quaternary alluvial sediments expected to be present beneath. According to Lazarus and Drakos (1995), the alluvium varies in thickness from five to 40 feet in the area of the site and unconformable overlies Tertiary to Quaternary formations included the Santa Fe Group, specifically the Ancha and Tesuque Formations.

The Ancha is similar to the underlying Tesuque Formation, having been derived from both the Precambrian bedrock and the Tesuque itself. The strata is described as a pinkish-tan gravel interbedded with minor amounts of sands and silts (McAda and Wasiolek, 1988) that lies unconformable atop the Tesuque.

The Tesuque Formation, consisting of alluvial fan and fluvial deposits, is variously described as "pinkish-tan soft arkosic, silty sandstone and minor conglomerate and siltstone" (McAda and Wasiolek, 1988) and "pink, tan, buff-colored silty to conglomeratic sand and sandstone typically interbedded with clay and siltstone beds" (Lazarus and Drakos, 1995).

Whereas the Ancha lies undeformed, the Tesuque Formation dips to the west approximately 10 to 25 degrees (Lazarus and Drakos, 1995; McAda and Wasiolek, 1988).

Based on soil borings conducted in December 2008 and January 2009 to a depth of about 40 feet, the geology of the site consists of unconsolidated deposits, with the following general sequence of deposits:

- Sand and silty sand, generally present from 0 – 20 feet below ground surface;
- Clay up to 4 and 4.5 feet thick, generally present around 20 feet below ground surface; and
- Gravelly sand, generally present below the clay layer and continuing down to 40 feet below ground surface.

The soil conditions were damp to moist, but not wet, indicating that groundwater was not encountered at any of the soil borings. Soil borings logs are provided in a soil sampling report discussed in Section 6.2 of this HSA and provided in Appendix J.

Regional Geologic Structure and Tectonics

The structural geologic features of the Santa Fe, New Mexico area are the result of relatively recent geologic activity, Tertiary and younger. As discussed above, Santa Fe is located near the eastern boundary of the Espanola Basin (Figure 2-5), which is one of a number of interconnected basins that make up the Rio Grande Depression. The development of the basins is the result of continental rifting that initially began 29 million years ago and continues today. Figure 2-6 includes a geologic timeline and summary of geologic events for the Santa Fe area.

The rifting that followed the early Tertiary Laramide orogeny and created the Sangre de Cristo range to the east, is described by some as a continuation of Laramide deformation (Chapin, 1979; Cather, 2004; Smith, 2004). The extensional forces which followed the compression of the Laramide created a series of uplifts and associated down-dropped fault blocks of significant elevation differences, as evidenced in the thickness of basin-fill sediments along the Rio Grande Rift Zone (Chapin, 1979).

Fault zones mark the structural boundaries of the Española Basin (Figure 2-8), including:

- to the east, north-south trending buried thrust faults along the Sangre de Cristo Range, suggesting that during basin formation Laramide and older faults may have been exploited;

- to the west, the Pajarito fault zone and possibly the Cañada de Cochiti fault zone further west, both north-trending (Broxton and Vaniman, 2004); and
- normal faults in the Embudo fault zone to the north.

The remaining significant structural features of the area also resulted from the regional rifting. Volcanism linked to faulting and crustal thinning within and adjacent to the Rift Zone in the Santa Fe area began around 14 million years ago and the resulting Jemez and Cerros del Rio volcanic fields bound the Española Basin on the west and southwest respectively.

Seismology

As would be expected considering the tectonic setting of the region (discussed above), New Mexico has an active seismic history. Researchers from the New Mexico Institute of Mining and Technology have developed catalogs of earthquakes for the state and bordering areas for the time frame of 1869 to 1998. Figure 2-9 (from Sanford, Lin, Tsai, and Jakash, 2002) illustrates the epicenters of earthquakes in the region having moment magnitudes of 3.0 or greater. A total of 155 events are plotted for the time period of 1962 to 1998. Evident on the figure is the concentration of events (36) in an area referred to as the Socorro Seismic Anomaly, approximately 140 miles south-southwest of Santa Fe. Seismicity in that area is attributed to crustal thinning and the presence of a large mass of magma beneath (Sanford, Lin, Tsai, and Jakash, 2002). Of note are a number of historic earthquakes along an identified fracture zone trending east-northeast in the area north of Santa Fe along (possibly consistent with the Embudo fault zone that bounds the Española Basin to the north) and the absence of obvious seismic activity trending north-south with the Rio Grande Rift.

Regarding seismicity in the area more local to the former Eberline facility, Broxton and Vaniman (2004) report that the Pajarito fault zone that forms the western boundary of the Española Basin remains active, and a strong earthquake occurred in 1918 approximately 25 miles southwest of Santa Fe. According to the United States Geological Survey (USGS) website, the modified Mercalli intensity of the event was VII – VIII with reports of a rupture of the earth's surface and residents being thrown from their feet (USGS, 2009).

According to a USGS seismic hazard map produced in 2008 (Figure 2-10), the site is situated in an area where a peak ground acceleration of 18 percent gravity has a two percent probability of exceedance in 50 years. The USGS references that 10 percent gravity "may be the threshold for damage to pre-1965 structures".

2.6 SURFACE WATER HYDROGEOLOGY

The former Eberline site is located in the Rio Grande Basin, which is typified by perennial mountain streamflow (derived from snowmelt and late summer rain) and ephemeral flow in the streams from the base of the mountains to the Rio Grande River (RF Weston, 1995). Presently, flow in certain basin streams is controlled by release from dams used to collect surface water for municipal use. Per the Office of the State Engineer, in 2005, surface water accounted for approximately 21 percent of the public water supply that totaled 12,967 acre-feet.

Surface water in the area surrounding the site includes:

- The Santa Fe River, approximately 0.8 miles north;
- An intermittent drainage approximately 0.4 miles south and southwest of the site that feeds the Arroyo de los Chamisos;
- The Rio Grande River located approximately 16 miles west; and
- Cochiti Reservoir on the Rio Grande to the west, which maintains a permanent pool of 50,000 acre-feet.

The nearest surface water feature for which flow data is available is the Santa Fe River. The river experiences intermittent flow primarily due to controlled discharges from two reservoirs located seven and nine miles upstream of the site, respectively. These reservoirs supply between 33 and 40 percent of the City of Santa Fe's public water (Roy F. Weston, 1995; Robbins, 2005). The nearest stations where flow is gauged by the USGS are approximately nine miles upstream (between the two reservoirs) and approximately 10 miles downstream at a location above Cochiti Reservoir. As the upstream station is above a reservoir and therefore is flow-controlled by the city, data for the downstream station number 8317200 was considered more representative of flow near the site. From October 2007 to September 2008, the mean discharge in the river was 6.02 cubic feet per second (cfs) with a peak flow of 348 cfs occurring on July 16, 2008 (USGS, 2008). The mean discharge for the 2008 USGS water year is illustrated in the plot on Figure 2-11.

The former Eberline site lies outside the 100-year floodplain of the Santa Fe River in an area characterized by FEMA as "Zone X - 0.2 percent annual chance flood" as shown on the Flood Insurance Rate Map included as Figure 2-12. Surface drainage at the site area is to the west and south based on the topographic map (Figure 2-1).

2.7 GROUNDWATER HYDROLOGY

Within the Espanola Basin, the Tesuque Formation is the most significant water-bearing unit and the primary aquifer for the City of Santa Fe (Roy F Weston, 1995; Lazarus and Drakos, 1995). Shallow groundwater has been detected at the top of the Tesuque along the contact with the overlying Quaternary alluvium at some locations, though the occurrence is discontinuous and controlled by factors such as the presence of paleochannels within the alluvium and the loss of shallow water into high-permeability fractures in the Tesuque (Lazarus and Drakos, 1995).

Recharge to the Tesuque occurs primarily via precipitation and streamflow infiltration along the Sangre de Cristo front to the east. This recharge at elevation provides the driving force for the regional flow direction to the west where groundwater ultimately discharges to the Rio Grande River (or its tributaries) or is intercepted by supply wells (Lewis and West, 1995; Lazarus and Drakos, 1995). Figure 2-13 illustrates regional groundwater flow patterns within the Espanola Basin, being from east to west, consistent with recharge areas in the Sangre de Cristo mountains, and the Rio Grande River as the primary receiving surface water. Also shown are the localized effects of pumping wells that supply the City of Santa Fe with approximately 26 percent of the public water (based on New Mexico Office of the State Engineer data for 2005).

Depth to groundwater in most area wells is greater than 200 feet (Lewis and West, 1995). Water is reported to be present at depths of less than 25 feet at the Tesuque/overlying alluvium boundary in close proximity to the Santa Fe River (Lewis and West, 1995; Lazarus and Drakos, 1995). No data was available regarding the depth to groundwater directly beneath the site.

An inventory of water supply wells surrounding the site (approximately four square miles and including topographic Sections 1 and 12, T17N, R8E, and Sections 6 and 7, T16N, R9E) was conducted through the New Mexico Office of the State Engineer (NMSE, 2009). The results show 187 wells in the area searched, with an average water depth of 309 feet below ground surface. The search results for the four topographic sections are included in Appendix F.

Groundwater is the primary natural resource present in the vicinity of the site. In 2005, groundwater made up approximately 59 percent of the total water withdrawal for Santa Fe County (per Office of the State Engineer), and 31,810 acre-feet of water were removed from the aquifer for public supply, irrigation, and commercial/industrial uses.

As illustrated in Figure 2-13, the direction of groundwater flow is generally to the west, perpendicular to the groundwater flow contours. Lazarus and Drakos (1995) report Tesuque Formation hydraulic conductivity ranges from 0.2-6.0 feet/day in the Espanola Basin as a whole with an estimated rate of 0.7 feet/day in area of Santa Fe. Those researchers also note an unpublished pumping test at the time from a city supply well that yielded a calculated conductivity of three feet/day. However, bail-down and slug testing yielded a range in hydraulic conductivity locally in the shallow alluvium/Tesuque boundary aquifer of 0.2 to 0.4 feet/day (Lazarus and Drakos, 1995).

2.8 *NATURAL RESOURCES*

Natural resource production, fuel and non-fuel, continues to play a significant role in the economy of New Mexico. Per the New Mexico Energy, Minerals and Natural Resources Department 2008 Annual Report, the production value of minerals in 2008 exceeded $2.2 billion dollars with an additional $2.2 billion in state revenues from oil and gas production (NMEMNRD, 2008).

Santa Fe County's role in natural resource production falls primarily in the minerals area, with aggregate in the form of crushed stone, sand and gravel, volcanic cinder, clay, and pumice all being mined in the area. The county is cited in the annual report as a leading producer of pumice and silica flux.

Oil production is very limited in the county, 17 barrels in 2006 and 81 in 2007, and there was no natural gas production.

In the area surrounding the former Eberline facility, commercial aggregate pits are common along the Santa Fe River to the north and northwest of the site, with the nearest pit located approximately 0.6 miles away. No mineral resources have been identified or mined on the site itself.

2.9 *THREATENED OR ENDANGERED SPECIES*

Based on a search of the Biota Information System of New Mexico (http://www.bison-m.org/speciesreports.aspx), there are 32 animal species in Santa Fe County that have status designations. These include three bird species listed as "endangered" at the federal or state level and 10 species (eight birds, one mammal, and one mollusk) listed as "threatened", as detailed below. In addition to the formal designations,

the state maintains an informal "sensitive taxa" list that includes 19 other species.

The species currently designated as "endangered" include:

- SW Willow Flycatcher (*Empidonal traillii extimus*)
- White-tailed Ptarmigan (*Lagopus leucura altipetens*), and
- the Least Tern (*Sterna antillarum athalassos*).

Species with a current state or federal status of "threatened" are:

- Bald Eagle (*Haliaeetus leucocephalus alascanus*)
- Peregrine Falcon (*Falco peregrinus tundrius*)
- Violet-crowned Hummingbird (*Amazilia violiceps ellioti*)
- Boreal Owl (*Aegolius funereus*)
- Burrowing Owl (*Athene cunicularia hypugaea*)
- Mexican Spotted Owl (*Strix occidentalis lucida*)
- Baird's Sparrow (*Ammodramus bairdii*)
- Gray Vireo (*Vireo vicinior*)
- American Marten (*Martes americana origenes*), and the
- Lilljeborg's Peaclam (*Pisidium lilljeborgi*).

Per the New Mexico Game and Fish *Threatened and Endangered Species of New Mexico 2008 Biennial Review* found at http://www.wildlife.state.nm.us/conservation/threatened_endangered_species/documents/2008BiennialReview.pdf, none of the species listed in Santa Fe County were recommended for a change in status in 2008.

At the Santa Fe facility, there are no public records indicating the presence of any of the species listed above. There are colonies of Gunnison's prairie dogs within the property's boundaries and while these animals are not considered "endangered" or "threatened", future sampling activities will not affect their presence.

3. FACILITY OPERATING & LICENSE HISTORY

3.1 INTERVIEWS

In order to develop operational history for the site, ERM identified persons of interest to be interviewed based on their work experiences or tenures with Eberline-TMO. Information obtained included the individual's responsibilities or positions, their recollection of the history of use, and most importantly the handling and storage of radiation sources and radioactive materials at the Airport Road facility. ERM independently developed an initial list of 22 known former employees who were involved in the operations of this facility; only four of these names were provided by TMO.

A questionnaire was developed, which included a request to name additional former employees who were involved in operations to develop further interviews with individuals whose selection was not potentially biased by the knowledge of the interviewers or ERM staff. With the exception of four additional names, the names of former employees provided during the interviews were on the initial list. The complete list of those interviewed and the content discussed has not been disclosed to TMO beyond the contents of this HSA in order to maintain the confidentiality of the respondents and the integrity of the historical investigation.

The former employees interviewed to support the HSA included past presidents, Radiation Safety Officers (RSOs), engineers, managers, technicians, shipping and receiving personnel, and members of the Isotopes Committee, with several that were employed when the Airport Road facility first began operation in 1968. Unfortunately, one former employee of great interest who served as the RSO during the receipt of the Americium Nitrate (AmN) was not interviewed due to his recent death. The information provided by the interviews, such as operating history, areas of source storage and use, and known releases is provided in the applicable sections below.

3.2 *FACILITY OPERATING HISTORY*

Eberline Instrument Corporation moved from a facility on Early Street in Santa Fe into the Airport Road facility in 1969. This facility has operated under the State of New Mexico RCB license Number CS067-25 with amendments and renewals from 1969 to present (Appendix B).

The radioactive material license allowed Eberline to use, store, accept and transship radiation sources and radioactive materials in a safe manner to customers. Eberline was in the business of designing, prototyping, manufacturing, selling and servicing many cataloged types of radiation detecting and monitoring instruments, detectors, devices and systems. The customers for these products ranged from nuclear power utilities, national nuclear laboratories and their contractors, radionuclide and source manufacturers, nuclear medicine departments at medical centers, hospitals and clinics, radiation therapy centers, and many of the other approximately 20,000 plus radioactive materials licensees of the NRC. Eberline was a leading supplier of radiation detectors.

The radioactive sources and materials were of several types, including encapsulated or sealed photon or gamma-emitters used in the deep shielded "wells", "stick" or lower level photon sources mainly using Cesium-137 or Cobalt-60 radionuclides, and electroplated alpha or beta-gamma sources and metallic Uranium sources used for precise beta emission rates. The radiation sources and radioactive materials were used to: 1) determine the minimum detectable activity or concentration that a given radiation detection system could measure; 2) check for the proper radiation response of an instrument or system over time and /or; 3) calibrate or recalibrate a radiation detector or system for linearity, precision or accuracy. Calibration sources were generally in a sealed form, except for sources that were used historically for calibration of liquid or gas monitoring instruments. The significant exceptions include a seven Ci source of Am-241, which is presently being stored on site prior to transfer, and a damaged 16 Ci Cs-137 source in a calibration well, which will be remediated. Uranium and thorium were also used in oxide forms. Additional information on the Am-241 source material is provided in Appendix L. Am-241 was never used in production at the Santa Fe facility but was transferred from the Albuquerque site prior to TMO divestiture for storage.

The areas of the facility that stored or managed radiation sources and radioactive materials were identified during the interview process, which is summarized on Figure 3-1. Storage and handling areas included the following:

- Engineering Source Storage Closets;
- Shipping and receiving areas;
- Customer service areas; and
- Laboratory and calibration areas.

Storage was within clearly identified rooms and areas of the facility. The two remaining areas are the well-source room and the radiation source storage room, both of which are locked and alarmed. The current inventory and location of radiological sources is provided in Table 3-1.

Other rooms or areas of interest where potential radioactive contamination may be present include the areas identified where Eberline products were returned by customers for service. Since radiation survey instruments were used by clients in locations that contain radioactive materials, it is possible that returned instruments may have been a source of radiological contamination. The areas of interest include rooms where Eberline products were received and serviced. These areas that stored radiation sources or radioactive materials were previously surveyed in 2008 by ERM/Dade Moeller and found to be free of radiological contamination (see Section 6.2 below).

All radiation sources and radioactive materials used, handled or stored at the Airport Road facility were maintained by people who had received training specifically designed to ensure the safe use, handling and storage of those materials. All manufacturing and engineering personnel were trained as radiation workers and the remaining employees were given basic radiation safety training. The training consisted of a review of the ionizing radiation physics for alpha, beta, gamma and neutron radiations, and an emphasis on the exposure mitigating factors of time, distance and shielding under the principles of As-Low-As-Reasonably-Achievable (ALARA). Following this training and based on their level of training and authority, a list of personnel approved to use, handle, transfer or store radiation sources and radioactive materials was published for in-house use. This training was administered by the Eberline RSO, trained in the comprehensive practice of health physics.

The facility has continued to be occupied by TMO since termination of operations in June 2007. Site operations since this time have been limited to maintenance of the facility; removal and/or disposal of radiation sources, preparations for remediation of the source wells through characterization sampling, and preparations for decommissioning and license termination.

3.3 *FACILITY LICENSE HISTORY*

The former Eberline facility on Airport Road in Santa Fe has been licensed to transfer, receive, possess and use radioactive material since it began operation in 1969. Eberline first requested a radiological license from the State of New Mexico in 17 December 1976 to consolidate their original licenses under the NRC, formerly known as the US Atomic Energy Commission (AEC): AEC BML No. 30-00692-03 and AEC SNML No. SNM-289. This license covered two Eberline facilities, one in Santa Fe (Early Street) and the other in Albuquerque, and was assigned License Number NM-EBE-BL-00 (Appendix B). This license remained in force until the fall of 1985 when the license was divided, and the facility in Santa Fe (Airport Road) was assigned a license by the RCB (license number CS067-25). It should also be noted that Eberline acquired four companies from California along with their radioactive materials license responsibilities: IRT in 1982, and National Nuclear, Reactor Experiments and Xetex between 1985-1987. The possession limits by radionuclide and activity level, and authorized activities for the Airport Road facility are outlined in a copy of the license, which is provided in Appendix B.

The licensee is required to maintain records of radioactive materials in their possession as well as records of receipt or shipment for five years. The source inventory that existed soon after termination of operations is provided in Appendix K. This inventory predates the most recent inventory forwarded to the RCB in 2008 (TMO, 2008).

3.4 *FACILITY DECOMMISSIONING HISTORY*

Based on former employee interviews and review of site records, there has been no radiological remediation performed at the site.

Efforts are ongoing to remove all radiological source material from the facility. As indicated above, several recent campaigns have resulted in shipments of licensed materials to other TMO locations. The remaining major sources at the site include an irradiator with three sealed sources, 7 Ci of Am-241 which will be converted to special form to enable future shipment, and 16 Ci of Cs-137 associated with a breached source (Table 3-1). Scoping surveys and searches of the facility uncovered minor sealed sources and process materials, which are currently stored in a locked safe and will be disposed with the Cs-137 source material.

3.5 *HISTORICAL SPILLS & ONSITE BURIALS*

This section documents historical radiological spills, releases or burials that may have occurred at the site based on interviews with former employees and review of available records to support radiological decommissioning and termination of the radioactive material license.

Each of the former employees interviewed declared that, to the best of their knowledge and with only two exceptions, there were no releases or spills of radioactive materials at the site during their tenures with Eberline. One reported incident involved the release of licensed radioactive material was a spill of Carbon -14 in a dosimetry trailer located outside the building (date unknown). Based on facility records and personnel interviews, there is no indication that the release occurred outside of the trailer or that there was any environmental contamination. This trailer was later transferred to the Eberline facility in Albuquerque, who at the time shared the radioactive material license with the Santa Fe facility. Subsequent to this Thermo Fisher divested it's relationship with the Albuquerque operation. The trailer apparently housed a dosimeter read out facility. The use of C-14 was presumably associated with calibration or source checks of radiation detection instruments. The quantity of C-14 released is unknown, but typical use associated with dosimetry would have been minor. There is no mention of processes that would have involved significant quantities of C-14 either within the interviews or as a licensed component.

The NRC's default screening level for C-14 on structural surfaces, 3,700,000 dpm/100 cm^2 (NRC FR 64134), which is approximately 100 times higher than the default screening level for Cs-137 (28,000 dpm/100 cm^2), indicating that C-14 is less hazardous than Cs-137. The scoping survey of the floors and walls of the facility (discussed in Section 6.2), which included beta radiation monitoring, would have detected a small faction at either screening levels. Wipe samples taken from the facility were analyzed by liquid scintillation counting, which is the best industry practice for detection of loose C-14 contamination, did not detect radioactivity above background levels.

This information will be included in the planning for the facility scoping survey and outside surficial sampling.

The second incident involved the apparent breach of a sealed source in a calibration well. This source contained an estimated 16 Ci of Cs-137. The material is presently in the high range subsurface storage well and plans are being formulated to remove the well and the source material for disposal as part of site decommissioning and license termination.

There were no other reports of accidents, incidents or events regarding the use, handling, shipping or storage of radiation sources or radioactive materials at the site. None of the interviewees reported the misuse of radiation sources over the history of facility operations.

No on site burials of radiological materials are known to have occurred at the site. There is evidence of disturbed soil on the northeast area of the property and a drain to the parking lot area, which will be included in the planning of outside soil surveys and sampling.

3.6 *REVIEW OF AERIAL PHOTOGRAPHS*

ERM conducted a review of available historic aerial photographs to verify reported information on site use and identify any areas of disturbance that could be associated with possible unidentified dumping or release of licensed radiological materials at the site. Aerial photographs reviewed dated back to 1935 and were as recent as 2005 (Appendix E). The early aerials reveal very little development through the 1950's, consistent with the reported development of the site. The first photograph showing the former Eberline facility is in an aerial taken in 1973 five years after construction of the main building. Several features are highlighted on the aerial photographs based on a review of operational records and interviews with former employees.

As shown in construction drawings (Appendix C) and aerial photographs (Appendix E) taken prior to construction, an effluent ditch ran across the property from east (off the site) to west, and remained in its original location following construction of the main building in 1968. The Engineering Annex was placed over this ditch in 1978 and another ditch appears to have been constructed around this addition and was subsequently removed (backfilled) sometime in the mid to late 1980's.

The 1986 aerial photograph shows a small trickle of liquid across the northern end of the parking lot originating from the northwest corner of the main building or loading dock area. Former employees noted the presence of this feature during operation, but were not familiar with its source. Photographs of the drain pipe (Photographs 8 through 10) and this area of the facility taken 26 March 2009 are provided in Appendix D.

The aerial photograph taken in 2005 shows what appears to be piles of dirt/concrete in the northeastern corner of the site inside the fenceline. This material is no longer at the site and, based on employee interviews, the material may have been sourced from construction projects adjacent to the site, unrelated to Eberline operations. Site photographs taken on 6

March 2009 shows that the area has been cleaned up, with minor evidence of building debris such as pieces of concrete, pipe and roofing material (Appendix D). Two concrete sections (about 1 foot by 4 feet) remain on the site.

A softball field existed north of the site in the 1980's, however it is no longer present.

4. RECORDS REVIEW

4.1 OVERVIEW

Readily available records were reviewed and/or obtained from federal, state and local agencies through data base searches, visits and correspondence. The review focused on records pertaining to radiological issues, permits and compliance, which allows for further assessment of the site's physical conditions and compliance history.

The facility is currently licensed by the RCB and their records were reviewed. Local agencies applicable to the facility include the City of Santa Fe Public Utilities Department which is responsible for the delivery of potable water, the collection and treatment of wastewater, and the collection and disposal of refuse.

4.2 DATA BASE RECORDS

ERM contracted Environmental Data Resources, Inc. (EDR) to conduct a database search of federal, state and local agency records associated with the property at 5981 Airport Road in Santa Fe, New Mexico. The report, presented in Appendix G, defines and summarizes the American Society for Testing and Materials (ASTM) databases reviewed in the EDR report and notes if any sites (including the Airport Road facility) were identified in the specified radius as being listed in pertinent environmental databases. Only those sites within the ASTM-specified distances are discussed below. It should be noted that the computerized geocoding technology used in the database search is based on available census data and is only accurate to approximately ±300 feet. The EDR report provides a list of unmapped sites for which inadequate location information was provided. ERM has reviewed the list of "unmapped" sites to determine if these sites are within the study radius. If the "unmapped" sites appeared likely to be within the search radius for a specific database, they are discussed in the sections that follow.

Based on maps of the area, the required database search radius for a given database, and the site reconnaissance, it appears that none of the pertinent unmapped sites are within the designated search distances and/or could have environmentally impacted the subject property.

Sites identified within the study radii were evaluated to determine if they are likely to have adversely impacted the subject property. The criteria used to evaluate the potential for adverse impact to the subject property include:

- Distance from the subject property;
- Expected depth and direction of groundwater and surface water flow;
- Expected storm water flow direction; and
- The presence/absence of documented contaminant releases at the identified sites that have not been remedied to the satisfaction of regulators.

The identification of a site as potentially up-gradient or down-gradient is based on the expected direction of groundwater flow to be down-gradient in all directions as the site is on top of a hill.

The EDR report provided search results from the following sources reviewed for the following years:

Source of Information	Years Reviewed
City Directories	1963, 1968, 1973, 1978, 1983, 1988, 1993, 1998, 2003, 2008
Topographic Maps	1951, 1977, 1993, 2001
Aerial Photographs (include aerials in provided in Appendix E)	1935, 1951, 1954, 1973, 1975, 1978, 1980, 1981, 1982, 1987, 1991, 1996

The following sections summarize the EDR findings and records reviewed from the various agencies responsible for implementing and enforcing radiological operations at the facility.

4.3 *FEDERAL RECORDS*

Preliminary Site Assessment - A Preliminary Assessment Report (dated March 1995) was conducted by Roy F. Weston, Inc. on behalf of the US EPA and under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the

Superfund Amendments and Reauthorization Act of 1986 (SARA) at the facility (Appendix H). Facility-related environmental "concerns" included the on-site drum storage of perchlorethane, thinners, solvents, paints and spent radioactive materials on a concrete slab inside a locked fence. No evidence of spills or leaks were reported or observed during their site visit. The report stated that the threat to groundwater, surface water, soil exposure and air migration pathways appeared minimal. The subject property was listed on the Comprehensive Environmental Response, Compensation, and Liability Information system No Further Remedial Action Planned (CERCLIS-NFRAP) database. This designation signifies that the assessment has been completed and that the EPA has determined that no further steps will be taken to list this site on the National Priorities List (NPL).

RCRA Status - The facility was identified on the RCRA-SQG and TSDF database under EPA ID Number NMD007106776 as a small quantity generator (SQG) and treatment, storage, or disposal facility (TSDF) of hazardous waste. The subject property received six violations between 1984 and 1995. All six violations were minor and were brought back into compliance in a timely manner.

FINDS Database - The site or facility was also identified on the Facility Index Database System (FINDS), likely as a result of the facility having a RCRA EPA identification number (NMD007106776) for the generation of hazardous waste. Besides the listing, no further information was provided in this database.

Other Federal Records - Other federal records (such as USGS and FEMA) were assessed to obtain information about physical properties of the site discussed elsewhere in the HSA. These records primarily consisted of geologic and hydrologic information, topographic maps and flood zone identification.

4.4 *STATE RECORDS*

ERM visited the RCB on 6 March 2009 to review available records. Records included correspondence between the RCB and the facility, RCB inspection records, and license amendments and modifications. The earliest correspondence available at the RCB was from 1985 and dealt with Eberline notification of the RCB of an update to members of the Isotope Committee. Site inspection records that were reviewed went as far back as 1990. A summary of the documents reviewed at the RCB is provided in Appendix M.

The RCB performed periodic, unannounced inspections of the facility, with violations cited in 1990, 1994, and 2000. These violations involved the documentation of leak tests at the required intervals, proper posting of radiological areas, inventory records not correlating with the license, and procedural changes not being provided to RCB. These were subsequently resolved in a timely manner to the satisfaction of the RCB.

The RCB issued an Administrative Compliance Order (ACO) to TMO on 28 February 2007, which stemmed from an allegation forwarded to the RCB from the NRC on 24 October 2005 in regards to site security and source inventory. The allegation was confirmed by the RCB through two facility inspections on 3 November 2005 and 22 December 2005, which resulted in a Notice of Violation (NOV) being issued 3 February 2006. Further inspections of the facility were performed by the RCB from 19-20 April 2006, which identified license and regulatory violations and lead to issuance of the ACO and payment of a civil penalty. All NOV and ACO issues have been resolved by TMO to the satisfaction of the RCB.

For the most part, other state agencies regulate and have jurisdiction over the non-radiological aspects of the facility. For completeness, ERM visited the Hazardous Waste Bureau on 6 March 2009 to review available records. These records confirmed the facility's RCRA filings and current RCRA operating status as "clean closed". TMO is currently registered as an SQG as a result of waste generation during cleanout/shutdown operations.

The NM Groundwater Quality Bureau was contacted and their information on the facility was limited primarily to the Preliminary Assessment Report performed by the EPA in 1995 discussed above (ERM, 2009b). The Bureau recently sent a request to the EPA (Region 6) to perform a reassessment of the site based on continued operations at the site (NMED, 2009a). A site visit was conducted by the Bureau on 26 January 2009 to familiarize themselves with the site.

4.5 *LOCAL RECORDS*

The facility has since construction, been connected to City of Santa Fe water and sewer system, which is managed by the Public Utilities Department. A sewer ditch easement for the City of Santa Fe transverses across the northern portion of the site. Prior to 1993, Eberline was permitted to discharge process waste from two spray paint booths, however, has been designated as a "no discharge" permittee since that time, discharging only sanitary wastes from bathroom facilities and sinks. Limited environmental files are maintained on the facility at local departments, including the Santa Fe County Assessor's Office, Planning

Board, Fire Department and Health Department records were reviewed at the former Eberline facility that dated back to 1963 (Appendix M). The records primarily consisted of shipping manifests, calibration logbooks, exposure surveys, training records, monitoring and survey results, radiological source inventories, and license modifications, amendments and renewals.

5.0 DECOMMISSIONING OBJECTIVES

5.1 UNRESTRICTED LAND USE

The process of decommissioning requires the safe removal of the facility from service and confirmation that any residual radioactivity that remains is at a level that permits release of the property and termination of the Radioactive Material License. TMO is decommissioning the facility and planning an unrestricted release of the site. Unrestricted release requires that residual radioactivity associated with the former use of licensed materials at the site, as distinguishable from background, results in a potential calculated dose from all pathways that does not exceed 0.25 mSv/yr (25 mrem/yr). In addition to this dose criteria, decommissioning activities will attempt to reduce residual radioactivity levels to maintain the dose as-low as-reasonably-achievable (ALARA). The ALARA criteria takes into account the state of technology and economics in reducing site-related radioactivity.

Based on the low level of contamination expected at the site and scoping surveys completed to date, it is anticipated that screening criteria provided in 10 CFR 20, Subpart E, will be used instead of developing site-specific dose estimates. Available screening criteria may include:

- A look-up table for common beta-/gamma-emitting radionuclides for building surface contamination (63 FR 64132, November 18, 1998);
- A look-up table for common radionuclides for soil surface contamination (64 FR 68395, December 7, 1999); and
- Screening levels derived using D and D, Version 2.0, for the specific radionuclide(s), using the code's default parameters.

As discussed with the RCB, the decommissioning objectives will be outlined in the Decommissioning Plan, including Derived Concentration Guidelines (DCGLs) to be used for site release, an estimate of anticipated future dose upon release, a summary of ALARA evaluations, intended *institutional controls (if any) and financial assurance (RCB, 2008).* Information derived through the development of the HSA will act as the basis for development of the Decommissioning Plan, which will outline the remaining steps to decommissioning based on information collected during the HSA, including identification of remedial areas and site release goals, final status survey requirements, and financial assurance.

Following public notice and approval of the Decommissioning Plan by the RCB, TMO would then apply for a termination amendment of the license and submit certification of the disposition of all licensed material in accordance with the regulations for decommissioning outlined in the New Mexico Radiation Protection Regulations, New Mexico Administrative Code (NMAC), Title 20.3.3.

5.2 *IDENTIFICATION OF POTENTIAL AOC'S AND INITIAL SITE CLASSIFICATIONS*

Based on the results of this historical site assessment, ERM has identified the following known or potential Areas of Concern (AOCs) as areas where past operations, use, storage and or releases of licensed radiological materials have, or may have, occurred that will require further assessment as part of the site characterization program, or in the case of the High Range Source Storage Well, remediation to abate the impact of the breached 16 Ci Cs-137 source within the well.

Summary of Known or Potential Areas of Concern (AOCs):

AOC/Location	*Rationale*
AOC-1 – Source Storage Wells	Site-related radioactivity associated with source storage and a breached Cs-137 source
AOC-2 – Engineering Source Storage Closets	Former source storage location
AOC-3 – Shipping & Receiving Areas	Handling of radioactive monitoring equipment
AOC-4 – Customer Service Area	Servicing of radiological monitoring equipment
AOC-5 - Laboratory & Calibration Areas	Use of licensed sources in site operations
AOC- 6- Former Dosimetry Trailer	Location of former dosimetry trailer where a release of C-14 was identified

AOC-7- Former Pre-1978 Effluent Ditch	Area where unidentified releases could potentially enter the environment pre-1978
AOC-8 – Engineering Annex Ditch	Area where unidentified releases could potential enter the environment post-1978 to mid-1980s
AOC-9 – Roof Drain Dry Well	Location where radioactivity in stormwater, if present, could enter the environment
AOC-10 – Former Drain Pipe	Location where liquid discharge was observed in 1986 aerial and drain pipe identified, source unknown
AOC- 11- Former Debris Piles	Location where uncontrolled disposal may have occurred at the site based on ground disturbance and residual debris

Each of the above AOCs will require further assessment as part of the site characterization program to: 1) confirm or refute if these potential AOCs are areas where site-related radioactivity may exist; and 2) define the nature and extent of any site-related radioactivity to determine the need for, and feasibility of, abatement necessary to meet goals for unrestricted land use post license termination.

Classifying the site into survey units is crucial to the survey design because it determines the level of survey effort based on the potential for contamination. Based on the findings of the HSA, areas of the site will be initially classified into three distinct classes:

- Class 1 Areas – areas known to be impacted, or likely to be impacted, by site-related radioactivity.
- Class 2 Areas – potentially impacted areas where residual radioactivity would not normally be expected, but maintains the potential for impact based on the site history or site-specific assessment.

- Class 3 Areas – non-impacted areas that are not anticipated to be impacted by radioactive materials at the site based on the site history of use of radioactive materials at the site and are confirmed based on site-specific assessment.

Non-impacted areas have no reasonable potential for residual contamination and require no further evidence to demonstrate compliance with the release criterion. When planning the Final Status Survey (FSS), impacted areas may be further divided into survey units. Class 1 areas require the highest level of survey effort because they are known to have contaminant concentrations above the DCGL, or the contaminant concentrations are unknown.

A preliminary classification of areas at the facility has been developed based on the HSA. A summary of Class 1 and Class 2 areas are shown in Figure 5-1 and 5-2, respectively. The balance of the facility and site is designated a preliminarily classification as a Class 3 area.

The preliminary Class 1 areas are the two locations that stored radiological sources: the well-source room and the radiation source storage room. The majority of the Class 2 areas are locations that might have been contaminated from returned instruments.

6.0 CONCEPTUAL SITE MODEL & CHARACTERIZATION PLAN

6.1 CONCEPTUAL SITE MODEL

The overall approach to assessing the potential for residual radioactive impacts at the site is based on the findings of this HSA, initial classifications of residual radioactivity and a pathway analysis. This combination of findings is best expressed through the development of a conceptual site model that summarizes the sources of potential impact to buildings and structures, the pathway by which site-derived radioactivity is released to the environment (e.g., spills and/or migration via site structures and release to the environment) and the estimated dose that a potential receptor would receive from residual radioactivity remaining in buildings, structures and/or the environment on the site.

The findings of this HSA has established through record searches, interviews, site reconnaissance, and radiological surveys completed to date, provides knowledge of potential locations of residual radiological contamination. In contrast, the pathway approach assumes that radionuclides escaped during licensed activities and that residual contamination exists. The analytical approach systematically identifies all possible release pathways and develops methods to quantify this contamination or establish that residual contamination is below the lower limits of detection for the surveys methods. The release pathways are established according to possible methods of transportation or sequestering of solid, liquid or airborne releases. Solid releases might be discovered on the site as soil contamination or elevated gamma radiation levels in outdoor areas, or as dust that is attached to surfaces. Liquid releases might have contributed to contamination in sink drains, floor drains, sumps, spill residues, dry wells, sewer lines, or outdoor seepage pits. Airborne releases could leave deposits in ducts, exhaust filters, or downwind locations. Depending on the elevation of the release point, the thermal buoyancy and velocity of the effluent stream, and the settling velocity of the particulates, the closest deposition may occur on rooftops. Rainfall may cause these deposits to accumulate at downspouts, drywells, ditches or other surface water pathways.

A comprehensive sampling and analysis program will be developed that applies both historical and pathways analysis to create a matrix of sample media and analytical methods that maximizes the probability of knowing the full extent of culpable contamination prior to commencing remediation activities. These two schemas are complementary because

the former establishes a measurement program based on likely results of documented actions and the latter formulates characterization sampling based on all possible physical transport pathways of unknown actions. The conceptual site model will act as a working hypothesis to assess potential radiological impacts to site buildings, structures and the environment and be continually updated based on the results of the site characterization program. Areas of defined site-related radiological impact resulting from the site characterization program will be the focus of the site Decommissioning Plan.

6.2 SITE CHARACTERIZATION PLAN

6.2.1 Completed Radiological Surveys and Investigations

Scoping Survey

In March 2008, ERM performed a scoping survey at the 5981 Airport Road facility. The survey included production, laboratory, engineering, and general office space, and consisted of surface scans and smear samples on walls and floors. In addition, each radioactive source well was scanned and logged for gamma radiation. A total of 69,500 SF of area was surveyed as part of this effort, however several areas remain that were inaccessible. A copy of the Scoping Survey Report (March 2008) developed from this activity is provided as Appendix I.

Upon completion of the survey it was determined that all accessible areas scanned were free from radioactive contamination except for two locations of fixed floor contamination adjacent to the high range well within the Radioactive Source Well Room. All contaminated items discovered during the survey were placed in appropriate radioactive waste receptacles, or sealed in a manner to prevent the spread of the contamination, labeled, and stored for eventual off-site disposal (Table 3-1).

Subsurface Soil Sampling

Subsurface soil sampling was performed at the site in and around the area of the four radioactive source wells between December 2008 and January 2009. A total of eleven (11) soil borings were advanced to evaluate the extent of potential radiological impact to soil; nine were around the neutron source wells, and two targeted the former high range Cesium-137 calibration well. Soil samples were collected within a nine-meter sphere around the neutron source well to a depth of approximately 40 feet below the floor slab, and to a depth of about 25 feet for the remaining borings. It had been assumed that soil within this sphere could potentially be

activated over time, due to the neutron source stored in the well and soil sampling was performed to validate this assumption. The draft soil sampling results report is provided as Appendix J.

No radionuclides were detected in subsurface soil that can be attributed to licensed operations of the facility. In particular, H-3, Fe-55, Co-60, Cs-137 and Europium radionuclides were below the minimum detectable activities of the analytical methods. Gross alpha and beta results were consistent with observed concentrations of K-40 and the U-238 and Th-232 decay chains. These results were discussed with the RCB on 19 February 2009, and were found to be in agreement with split sample analysis conducted by the RCB (Appendix A).

6.2.2 *Future Radiological Sampling and Analysis*

Based on the conceptual site model, TMO will develop a Field Sampling Plan that will include investigation of potential radiological residues from interior areas previously inaccessible, identified interior and exterior AOCs, roof areas, ventilation ducts, liquid drains, and groundwater.

As the planned sampling and analysis is implemented, the data generated will be reviewed to determine if data gaps exist or if additional biased sampling should be conducted. Some survey methods may include biased sampling that will be specified according to the results of the initial measurements. For example, the gross gamma soil survey will collect information on surface radiation levels. If areas of elevated gamma radiation are recorded, the surface soil will be sampled at the locations with the highest readings. In some cases, the results of these analyses may identify possible residual contamination that is best examined during the remediation process. Generally, if the planned sampling uncovers contamination and the initial results are sufficient to plan remediation, no further characterization is needed and the exact extent of the excessive residual contamination will be determined during the remediation process. However, if the initial results are suggestive, but not conclusive, then a data gap exists and further analysis is required.

Data gaps can also occur if initial results indicate that sampling should be expanded to delineate the extent of contamination for budgeting purposes or if additional radionuclide analyses are needed to determine appropriate DCGLs or if potential hazardous constituents must be evaluated to support waste management programs. In the case of soil sampling, data gaps may occur if areas of disturbed soil are observed with no documentation regarding the cause of the disturbance. In such cases,

soil samples may be collected to determine if the soil is contaminated. In some cases, data gaps are addressed by scheduling further surveys during remediation, if the planned actions will provide better access to the materials that may be contaminated. This situation is typically associated with hard-to-sample locations that will be exposed in the process of known remediation actions. In the case of the Santa Fe facility, the soil within one meter of the bottom of the neutron source well is a prime example. There is no need to sample this soil during characterization because the soil will be exposed as the well is removed and a soil survey would be performed at that time.

The combined historic and pathway analysis approach has been applied to:

Buildings & Structures: The historical documentation was used to identify those rooms where residual radioactive material may exist as a result of facility operations and areas that were inaccessible or excluded from earlier scoping surveys. The pathways analysis was applied to determine how this material could have been transported from the origin of a leak or spill. The data was applied to determining which rooms, ducts, drains and related items should be covered in the Field Sampling Plan. The roof will also be surveyed for alpha, beta and gamma radiation.

Soil: There is no indication that operations were conducted outdoors or that material was buried on the site. There is anecdotal evidence of a spill of C-14 in an outdoor area. The pathway approach was applied under the assumption that contamination was dispersed in outdoor areas. The result is that soil in the area of the anecdotal spill will be sampled for C-14. The entire site will be scanned for gross gamma and visual anomalies. Areas of elevated gross gamma and visual anomalies (e.g. disturbed soil) will be sampled. A downspout will be excavated to determine if it connects to a surface drain or subsurface bubbler, and then will be sampled.

Groundwater: As there is currently no existing on-site well, existing wells in the vicinity of the site will be sampled and the water will be analyzed for H-3, C-14, and gamma isotopes.

Data quality objectives would be developed in the Field Sampling Plan to assure that the data collected is of sufficient quality to support decisions about the site. A final analytical report would be developed following sampling to support decommissioning and license termination activities.

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